and effects are similar to those described for the NDD above. Any habitat temporarily or permanently affected from construction is analyzed in the specific construction activities described above and any reinitiation triggers will be associated with those specific actions.

9.5.4 Effects to Recovery

For a species like the giant garter snake that has lost much of its former habitat, recovery would necessitate the conservation of much of the remaining habitat that still supports it. Reclamation and DWR are proposing to minimize the adverse effects of the loss of suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation and DWR have proposed to restore or protect suitable habitat to offset the total loss of suitable habitat. Habitat loss and degradation are contributing factors to the decline of giant garter snake; consequently, restoration or protection of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of the giant garter snake. Consequently, we conclude that the PA would not interfere with the recovery of the giant garter snake.

9.5.5 Reinitiation Triggers

Some project elements and their effects on giant garter snake may change as DWR continues to develop the PA (*e.g.*, location of the geotechnical explorations, water availability as a result of operation of the facilities) and therefore may require reinitiation if additional effects are likely occur beyond those analyzed herein.

9.5.6 Cumulative Effects

The activities described in Section 9.2.5 for delta smelt are also likely to affect giant garter snake. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5 are incorporated by reference into this analysis for the giant garter snake.

9.5.7 Conclusion

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the giant garter snake.

Reproduction

The giant garter snake is found in the action area and several occurrences have been documented from 2013 to 2016 in the western Delta (CDFW 2016, DWR 2015, Service 2016, Stillwater Sciences 2017). Actions from the project may reduce local reproduction as disturbances from construction and the removal of habitat are likely to interfere with normal giant garter snake mating behaviors and fecundity. The reduction in reproductivity in and around the project is anticipated to cause a reduction in the sub-population in the Delta recovery unit for the giant garter snake; however, it is not anticipated to result in the extirpation of giant garter snake and the Service anticipates that giant garter snake will be able to recover the loss of reproduction potential in habitat areas that are proposed to be protected or restored as a conservation measure for the species. Therefore, the PA will not appreciably affect giant garter snake reproduction that would lead to extirpation within the action area and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

Numbers

The number of giant garter snakes in the action area is relatively low compared to the populations in the Sacramento Valley and populations east of the Delta Recovery Unit based on recent and past records (CDFW 2013, Service 2015). Also, Reclamation and DWR have proposed measures to avoid and minimize the effects of the PA on the species. Despite the proposed protection measures, we anticipate the PA may still result in adverse effects to the giant garter snake; however, the number of giant garter snake affected would be relatively low. This is especially true relative to the range-wide numbers. Therefore, the PA will not appreciably reduce the number of giant garter snake and we conclude the number of giant garter snakes throughout the species' range would not decline.

Distribution

The number of giant garter snakes likely to be affected by projects activities will be relatively low in relation to the species' population numbers range-wide. We also conclude that although giant garter snake will likely experience a reduction in population numbers within the delta recovery unit, they will continue to survive in the action area. Consequently, the water conveyance facility construction will not alter the distribution of the giant garter snake and we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

Conclusion

After reviewing the current status of the giant garter snake, the environmental baseline for the action area, the effects of the PA, and the cumulative effects, it is the Service's biological opinion that the PA is not likely to jeopardize the continued existence of the species. We have reached this conclusion because:

1. The number of giant garter snakes likely to be affected by projects activities will be low relative to the number of giant garter snake range-wide.

2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of giant garter snake's survival and recovery because many more individuals and larger habitat areas outside of the action area will remain.

3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects.

4. Reclamation and DWR propose to restore or protect habitat that could support the giant garter snake.

5. The project is being implemented in a manner that will minimize damage to areas that could support the giant garter snake.

9.5.8 Giant Garter Snake Literature Cited

California Department of Fish and Wildlife. 2010, 2012, 2014. California Natural Diversity Data Base (CNDDB). Natural Heritage Division, Sacramento, California. https://map.dfg.ca.gov/bios

California Environmental Protection Agency. 2006. Climate Action Team Report to Governor Schwarzenegger and the Legislature.

(DWR) California Department of Water Resources.2015 Biological Assessment for the West False River Emergency Drought Barrier Project. Prepared by AECOM, July 2015. 36 pp. plus appendixes.

(DWR). 2009, 2010. Annual report for permit TE-835365-5, provided to the Sacramento Fish and Wildlife Office by Laura Patterson, DWR.

Hansen, E. 2009. Giant garter snake (*Thamnophis gigas*) surveys on the Capital Conservation Bank Site: Yolo County, CA. Draft report prepared by Eric Hansen. Dated October 15, 2009.

Hansen, G. E. 1986. Status of the giant garter snake *Thamnophis couchi gigas* (Fitch) in the Southern San Joaquin Valley During 1986. Final report for California Department of Fish and Game, Standard Agreement No. C-1433. Unpublished. 31 pp.

Huey, R.B., Deutsch, C.A., Tewksbury, J.J., Vitt, L.J., Hertz, P.E., Pérez, H.J.Á. and Garland, T., 2009. Why tropical forest lizards are vulnerable to climate warming. Proceedings of the Royal Society of London B: Biological Sciences 276(1664):1939-1948.

Lenihan, J.M., Bachelet, D., Neilson, R.P. and Drapek, R., 2008. Response of vegetation distribution, ecosystem productivity, and fire to climate change scenarios for California. Climatic Change 87:215-230.

Loarie, S.R., Carter, B.E., Hayhoe, K., McMahon, S., Moe, R., Knight, C.A. and Ackerly, D.D., 2008. Climate change and the future of California's endemic flora. PloS ONE 3(6).

McMenamin, S.K., Hadly, E.A. and Wright, C.K., 2008. Climatic change and wetland desiccation cause amphibian decline in Yellowstone National Park. Proceedings of the National Academy of Sciences 105(44):16988-16993.

(Service) U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants: Proposed endangered status for the giant garter snake, December 27, 1991. Federal Register 56(249):67046-6705.

(Service) U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; determination of threatened status for the giant garter snake; final rule. Federal Register 58(201):54053-54066.

(Service) U.S. Fish and Wildlife Service. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). U.S. Fish and Wildlife Service, Portland, Oregon. 192 pp.

(Service) U.S. Fish and Wildlife Service. 2006 Giant Garter Snake (*Thamnophis gigas*) 5 year review. U.S. Fish and Wildlife Sacramento Fish and Wildlife Office.

(Service) U.S. Fish and Wildlife Service. 2012 Giant Garter Snake (*Thamnophis gigas*) 5-year review. U.S. Fish and Wildlife Sacramento Fish and Wildlife Office.

(Service) U.S. Fish and Wildlife Service. 2015. Revised Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). U.S. Fish and Wildlife Service, Sacramento, CA. 74 pp.

(Service) U.S. Fish and Wildlife Service. 2016. Records kept by the Service from various sources of documented giant garter snake occurrences for Jan to May of 2016.

Stillwater Sciences. 2017. Technical Memorandum: Jersey Island Levee Bank Protection Project: pre-construction survey methods and results for stations 390+00 to 475+00. Prepared for MBK Engineers. June 2, 2017.

Swaim, K. 2004. Results of surveys for the giant garter snake (*Thamnophis gigas*) in Marsh Creek and the Contra Costa Canal, Northeast Contra Costa County, California. Prepared for Sycamore Associates by Swaim Biological Inc. January 22, 2004.

Swaim, K. 2005a. Results of surveys for the giant garter snake (*Thamnophis gigas*) at the Lesher Property in Contra Costa County, California. Prepared for Sycamore Associates by Swaim Biological Inc. October 3, 2005.

Swaim, K. 2005b. Results of surveys for the giant garter snake (*Thamnophis gigas*) at the Biggs Property in Contra Costa County, California. Prepared for Sycamore Associates by Swaim Biological Inc. October 3, 2005.

Swaim, K. 2005c. Results of surveys for the giant garter snake (*Thamnophis gigas*) at the Dal Porto North Property in Contra Costa County, California. Prepared for Sycamore Associates by Swaim Biological Inc. October 3, 2005.

Swaim, K. 2005d. Results of surveys for the giant garter snake (*Thamnophis gigas*) at the Dal Porto South Property in Contra Costa County, California. Prepared for Sycamore Associates by Swaim Biological Inc. October 3, 2005.

Swaim, K. 2006. Survey results for the giant garter snake (*Thamnophis gigas*) at the Gilbert and Burroughs properties in Contra Costa County, California. Prepared for Zentner and Zentner by Swaim Biological Inc. February 27, 2006.

Whitfield, S.M., Bell, K.E., Philippi, T., Sasa, M., Bolaños, F., Chaves, G., Savage, J.M. and Donnelly, M.A., 2007. Amphibian and reptile declines over 35 years at La Selva, Costa Rica. Proceedings of the National Academy of Sciences 104(20):8352-8356.

Wylie, G. D. and M. Amarello. 2007. Surveys for the current distribution and abundance of giant garter snakes (*Thamnophis gigas*) in the southern San Joaquin Valley. Prepared for the Bureau of Reclamation by the U. S. Geological Survey, Biological Resources Division, Dixon Field Station, Dixon, California.

Wylie, G. D., M. L. Casazza, and N. M. Carpenter. 2002. Monitoring giant garter snakes at Colusa National Wildlife Refuge: 2001 progress report. Unpublished report. U.S. Geological Survey, Biological Resources Division, Dixon Field Station, Dixon, California. April 2002. 10 pp.

Wylie, G. D., M. L. Casazza, L. L. Martin, and N. M. Carpenter. 2003. Monitoring giant garter snakes at Colusa National Wildlife Refuge: 2002 progress report. Unpublished report. U.S. Geological Survey, Biological Resources Division, Dixon Field Station, Dixon, California. 16 pp.

Wylie, G. D., M. L. Casazza, L. L. Martin, and N. M. Carpenter. 2005. Identification of Key giant garter snake Habitats and Use Areas on the Sacramento National Wildlife Refuge Complex. USGS-BRD, Western Ecological Research Center, Dixon Field Station. 31 pp.

Wylie, G.D., and L. Martin. 2004. Results of 2004 monitoring for giant garter snakes (*Thamnophis gigas*) for the bank protection project on the left bank of the Colusa Basin Drainage Canal in Reclamation District 108. Sacramento River Bank Protection Project, Phase II. Progress report for the U.S. Army Corps of Engineers.

Personal Communication

Wylie, Glenn. U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, personal communication 2006, 2009.

9.6 Least Bell's Vireo

9.6.1 Status of the Species

The Service listed the least Bell's vireo as endangered in 1986 (51 FR 16474). Large-scale loss of habitat reduced the number of sites where it breeds and curtailed its numbers; nest parasitism by the brown-headed cowbird (*Molothrus ater*) reduced nesting success within much of the remaining breeding habitat. At the time of listing, the Service estimated that 300 territorial males remained in the United States. The project site is not within designated critical habitat for this species and it will not be discussed further.

Recovery Plan

The draft recovery plan for the least Bell's vireo (Service 1998) describes a strategy for securing and managing riparian habitat within its historical breeding range; the Service also recommended annual monitoring, range-wide surveys, and research to monitor and guide recovery. Specifically, the draft recovery plan recommends the criteria for achieving threatened status as stable or increasing populations or metapopulations, each consisting of several hundred or more breeding pairs that are protected and managed at 11 sites along the central and southern California coast and in the vicinity of Anza Borrego in the desert. Recommended delisting criteria include meeting the goal for threatened status, establishing increasing populations or metapopulations along the Salinas River and in the San Joaquin and Sacramento valleys, and a reduction or elimination of threats to the point where least Bell's vireo populations can persist without significant human intervention.

Five-Year Review

The 5-year review for the least Bell's vireo (Service 2006c) is incorporated by reference to provide additional information relevant to the status of the species. The following paragraphs provide a summary of the relevant information in the 5-year review.

In our 5-year review, we recommended revising the status of the species from endangered to threatened because of a ten-fold increase in abundance since listing, expansion of breeding locations throughout southern California, and conservation and management of suitable breeding habitat throughout its range. By 2005, the Service was aware of approximately 2,968 known territories in the United States with the greatest increases in San Diego and Riverside counties. The number of pairs in Orange, Ventura, San Bernardino, and Los Angeles counties also increased substantially; a few isolated individuals and breeding pairs have also been observed in Kern, Monterey, San Benito, and Stanislaus counties. Since publication of our 5-year review, surveys have detected breeding territories along the Amargosa River in the northern Mojave Desert (McCreedy and Warren 2015a) and Whitewater Canyon, Chino Canyon, and Mission Creek in the Coachella Valley (Hargrove *et al.* 2014). The increase in the abundance of least Bell's vireos since the listing is primarily due to efforts to reduce threats such as loss and degradation of riparian habitat and parasitism by brown-headed cowbirds. The control of invasive plants has also increased the amount of suitable habitat available for nesting.

The 5-year review also contained several recommendations for future management of the least Bell's vireo. These recommendations are to finalize a recovery plan for the least Bell's vireo with realistic, objectively based recovery goals; provide funding and technical support for further studies investigating continuing threats from parasitism by brown-headed cowbirds and invasion of riparian habitats by exotic plants, and potentially elevated predation pressures due to habitat fragmentation or presence of exotic predators; develop and implement a systematic program to survey the Salinas, San Joaquin, and Sacramento Valleys and inform future management; and develop systematic survey programs for watersheds in southern California that are not regularly surveyed within a given 5-year period.

West Nile virus may affect some groups of birds disproportionately, either temporarily or persistently (George *et al.* 2015). For example, George *et al.* (2015) found that red-eyed vireos (*Vireo olivaceus*) "experienced significant declines in survival associated with the arrival of [West Nile virus], followed by recoveries to pre-[West Nile virus] levels. Conversely, warbling vireos (*Vireo gilvus*) experienced smaller annual declines in survival than red-eyed vireos after the arrival of West Nile virus but the survival rate continued to decline in subsequent years. We do not know how West Nile virus would affect the least Bell's vireo over time.

Reproduction and Habitat Requirements

Least Bell's vireo is an obligate riparian breeder. The least Bell's vireo typically breeds in willow riparian forest supporting a dense, shrubby understory of mulefat (*Baccharis salicifolius*) and other mesic species (Goldwasser 1981; Gray and Greaves 1984; Franzreb 1989). Oak woodland with a willow riparian understory is also used in some areas (Gray and Greaves 1984), and individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage (Brown 1993). Similar habitats are used during the winter months. Goldwasser (1981) and Salata (1983) believed that structure and composition of vegetation below 3 and 4 m, respectively, were critical. Salata (1983) also reported the importance of a mix of tree size classes, with a mean height of 8 m. Gray and Greaves (1984) recommended protection of ground cover and low shrub layers. Vireos occur in disproportionately high frequencies in the wider sections (greater than 250m) of the riparian relative to site availability (RECON 1989).

Early successional riparian habitat typically supports the dense shrub cover required for nesting and a diverse canopy for foraging. Although least Bell's vireo tend to prefer early successional habitat, breeding site selection does not appear to be limited to riparian stands of a specific age. If willows and other species are not managed, within 5 to 10 years they form dense thickets and become suitable nesting habitat (Goldwasser 1981; Kus 1998). Tall canopy tends to shade out the shrub layer in mature stands, but least Bell's vireo will continue to use such areas if patches of understory exist. In mature habitat, understory vegetation consists of species such as California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), grape (*Vitis californica*), and perennials that can conceal nests.

Least Bell's vireos use upland habitat, in many cases coastal sage scrub, adjacent to riparian habitat. Vireos along the edges of riparian corridors maintain territories that incorporate both habitat types, and a significant proportion of pairs with territories encompassing upland habitat place at least one nest there (Kus and Miner 1989). The least Bell's vireo arrives on its breeding grounds in mid-March (Brown 1993), with males arriving slightly before females (Nolan 1960; Barlow 1962). This vireo shows a high degree of nest site tenacity (Greaves 1987). Most individuals depart by September (Brown 1993), although some individuals remain on their breeding grounds into late November (Rosenberg *et al.* 1991).

Uplands adjacent to riparian areas provide migratory stopover grounds, foraging habitat, and dispersal corridors for nonbreeding adults and juveniles (Kus and Miner 1989; Riparian Habitat Joint Venture 2004). Foraging occurs most frequently in willows (Salata 1983; Service 1998), but occurs on a wide range of riparian species and even some nonriparian plants that may host relatively large proportions of large prey (Service 1998).

Territory size ranges from 0.5 to 7.5 acres (0.2 to 3 hectares), but on average are between 1.5 and 2.5 acres (0.6 and 1 hectare) in southern California (Service 1998). Spatial differences in riparian habitat structure, patch size, and numerous other factors result in differences in the density of territories within and between drainages.

The main impediments to successful reproduction for least Bell's vireos are nest parasitism by brown-headed cowbirds and availability of suitable breeding habitat. We expect that the continued management of brown-headed cowbirds and restoration of riparian habitat is likely to allow for the continued successful reproduction of the least Bell's vireo.

Numbers

The Service does not conduct regular surveys throughout the range of the least Bell's vireo. The U.S. Geological Survey collects data from biologists conducting surveys for the least Bell's vireo; various workers survey some areas regularly and other results are acquired from surveys that are conducted in support of other activities (*e.g.*, monitoring, preparation of environmental documents for development reviews, etc.). Additionally, not all sites are surveyed every year and the precise locations of surveys may vary from year to year. Consequently, the numbers of territorial males in Table 9.6.1-1 (adapted from Kus *et al.* 2014) do not represent a trend; they do, however, indicate that least Bell's vireos have increased in abundance since the time of listing.

Table 9.6.1-1 Number of least Bell's vireo territorial males.

Year	Number of Territorial Males
2003	1,604
2004	2,098
2005	2,068
2006	1,823
2007	2,088
2008	2,521
2009	3,075
2010	3,280
2011	2,917
2012	2,455
2013	2,597
2014	2,477

Distribution

Least Bell's vireo is one of four subspecies of Bell's vireo and is the only subspecies that breeds entirely in California and northern Baja California. Least Bell's vireo had a historical distribution that extended from coastal southern California through the San Joaquin and Sacramento Valleys as far north as Tehama County near Red Bluff (Kus 2002). The Sacramento and San Joaquin Valleys were the center of the historical breeding range supporting 60 to 80% of the population (51 FR 16474).

The distribution of the least Bell's vireo has increased to some degree since its listing in 1986, although it remains absent from large parts of its former range in the Central Valley. Two recent nesting events, 2005 and 2006 at the San Joaquin River National Wildlife Refuge, and 2010 and 2011 along Putah Creek in Yolo Bypass, indicate the species is attempting to recolonize the Central Valley. We expect that the distribution of least Bell's vireos is likely to continue to increase slowly in the future.

9.6.2 Environmental Baseline

Data on least Bell's vireos from the 1940s through the 1960s are lacking, but extensive surveys of the Central Valley in the late 1970s did not detect a single individual (Goldwasser *et al.* 1980). Least Bell's vireos are rarely observed in the Central Valley; according to eBird, the species has been observed at 7 distinct locations between 2005 and 2013. No individuals have been observed in the Central Valley in the last 3 years. There are no CNDDB records of least Bell's vireos breeding in the action area since at least the 1970s. Two singing males were detected in the Yolo Bypass Wildlife Area (approximately 8 miles from the action area) in mid-April 2010, and again in 2011 (CDFW 2013). No least Bell's vireos were detected in the Yolo Bypass Wildlife Area during surveys in 2012. A singing male was detected in 2013, and surveys were not conducted in 2014 (Whisler personal communication 2015). No least Bell's vireos were detected in the Yolo Bypass in 2015 or 2016, and the site appears to have been abandoned.

The next-nearest known nest site since the 1930s is approximately 4.5 miles south of the action area at the San Joaquin River National Wildlife Refuge in the San Joaquin and Tuolumne River floodplain (Howell *et al.* 2010). This occurrence includes three nests between 2005 and 2007, all in a recently restored portion of San Joaquin River National Wildlife Refuge lands known as "Hagemann's Fields 6 and 9." The 2005 and 2006 nests were successful. The 2007 nest was not successful in that only a female returned to the area, and though it constructed a nest and laid eggs, the nest failed. The 2005 and 2006 nests were in a 3-year-old arroyo willow with understory plants including mugwort, sunflower, gumplant, and creeping wild rye. The 2007 nest was in a dead arroyo willow (Howell *et al.* 2010).

Least Bell's vireos have not been detected within or around the project construction sites; however, surveys have not been conducted. Least Bell's vireos have been detected north of the project area, and those birds likely migrate through the action area. Therefore, least Bell's vireo likely stopover in and use the construction disturbance area for feeding, resting and sheltering during their migration.

9.6.3 Effects of the Proposed Action

It was not possible to do field surveys of the entire action area for the least Bell's vireo because many of the properties are in private ownership. Therefore, suitable modeled habitat was used to identify areas of potential effects. The permanent loss of suitable riparian and scrub habitat is expected as a result of the PA activities. The loss of suitable habitat could diminish available foraging and sheltering habitat for the least Bell's vireo.

Disturbance of least Bell's vireos may cause individuals to move more frequently than they would under natural conditions and result in energy expenditures that could affect the ability of the individual to survive. Workers, equipment, or the placement of ancillary flood control project structures may create enough noise or disturbance to flush least Bell's vireos temporarily from suitable habitat or cause them to avoid small areas of suitable habitat within or adjacent to the action area or abandon it and to seek out new territories. Noise and human/vehicle presence associated with project activities could flush least Bell's vireos from suitable habitat exposing them to higher predation risk and increased energy expenditure.

Water Conveyance Facility Construction

Activities associated with water conveyance facility construction that could adversely affect least Bell's vireos include: the north Delta intakes, tunneled conveyance facilities, reusable tunnel material, power supply and grid connection. These construction activities will destroy or modify habitat that migrating least Bell's vireo use for feeding, resting, and sheltering. Water conveyance facility construction is estimated to last 12 - 15 years, which is long enough to assume that least Bell's vireo will avoid using the estimated 32.25 acres of modeled habitat over the long-term, resulting in permanent impacts from water conveyance facility construction. Construction of the north Delta intakes will result in the loss of an estimated 5 acres of least

Bell's vireo suitable habitat. Construction of the Tunneled Conveyance Facilities will result in the loss of an estimated 11.25 acres of least Bell's vireo habitat. Placement of reusable tunnel material will result in the loss of an estimated 12 acres of least Bell's vireo habitat. Construction of the transmission lines will result in the loss of an estimated 4 acres of least Bell's vireo habitat. The loss will be offset through riparian creation or restoration at a 2:1 ratio for a total of 64.5 acres.

Water Conveyance Facility Construction - Noise, Lighting, Vibration, Bird Strikes on Transmission Lines

In addition to the habitat loss, construction itself has the potential to adversely affect least Bell's vireo. Construction that occurs when the vireo is migrating through the action area (using non-breeding habitat as a stopover to rest or forage) has the potential to harass least Bell's vireos due to noise, vibration, and nighttime lighting effects causing them to move to other locations which could expose individual vireos to increased predation and decreased foraging opportunities. When noises or disturbances are repeated over a long period, they could cause physiological stress to migrating least Bell's vireo.

Intake construction will require the use of loud, heavy equipment within the construction sites as well as along the access reads to the site. Pile driving for the north Delta intakes will create noise and vibration effects. Ongoing maintenance activities at the intakes include intake dewatering, sediment removal, debris removal, and biofouling and corrosion removal and will occur from water-based equipment approximately annually. These activities will have noise and lighting effects.

The tunneled conveyance facilities include tunnel work areas, vent shafts, the pumping plant and shaft location, a new forebay and spillway, tunnel conveyors, barge unloading facilities, fuel stations, and concrete batch plants. Construction noise up to 60 dBA will occur at up to 2,000 ft from the forebay and spillway construction footprint. These activities will have noise and lighting effects.

Power supply and grid connections include construction of temporary power lines to power construction activities and construction of permanent transmission lines to power conveyance facilities. Construction of new transmission lines will require site preparation, tower or pole construction, and line stringing. These activities will have noise and lighting effects. Migrating vireos may be subject to bird strikes at the transmission lines.

RTM activities at each site will include the use of heavy equipment for ground clearing and grading and soil tilling and rotation. Material will be moved to the site using a conveyor belt for long-term on-site storage. These activities will have noise and lighting effects.

Construction activities will create noise up to 60 dBA at no more than 1,200 ft from the edge of the construction footprint unless pile driving is required, in which case noise up to 60 dBA could reach up to 2,000 ft from the edge of the construction footprint. While 60 dBA is the standard noise threshold for birds (Dooling and Popper 2007), this standard is generally applied during the nesting season, when birds are more vulnerable to behavioral modifications that can cause nest failure. There is evidence, however, that migrating birds will avoid noisy areas during migration (McClure *et al.* 2013). To minimize this effect, the noise in the vicinity of least Bell's vireo habitat will be reduced as described in the CWF BA Appendix 3.F, *General Avoidance and Minimization Measures* section. This will include surveying for least Bell's vireo within the 60 dBA noise contour around the construction footprint, and if a least Bell's vireo is found, limiting noise to less than 60 dBA where the bird occurs until it has left the area. Pile driving will be limited to daytime hours within 1,200 ft of least Bell's vireo habitat.

Night lighting may also have the potential to affect migrating least Bell's vireos. While there is no data on effects of night lighting on migration for this species, studies show that migrating birds of other species are attracted to artificial lights and this may disrupt their migratory patterns or cause collision-related fatalities (Gauthreaux and Belser 2006). To minimize this effect, all lights will be screened and directed away from least Bell's vireo habitat as described in the CWF BA Appendix 3.F, *General Avoidance and Minimization Measures* section. There will still be some potential, however, for light-related effects to occur.

It is possible for migrating least Bell's vireo to be injured or killed by colliding with the transmission lines. All project and existing transmission lines will have bird strike diverters installed in a configuration that research indicates will reduce bird strike risk by at least 60% or more, as described in the CWF BA Appendix 3.F, *General Avoidance and Minimization Measures* section. With this implementation of this measure, least Bell's vireo collisions with transmission lines are not likely to occur.

The activities listed above are expected to affect least Bell's vireo in the form of harm and harassment. Construction activities are estimated to result in the permanent habitat loss of 32.25 acres.

9.6.4 Effects to Recovery

Noise, lighting and vibration also have the potential to temporarily cause adverse effects to the least Bell's vireo. These threats will be minimized by Reclamation's proposal to restore or protect suitable habitat for the least Bell's vireo. The restoration and protection of riparian habitat will benefit the least Bell's vireo because of the importance of this habitat type for this species. The relatively small amount of habitat that will be lost (approximately 32 acres as a result of the construction of the water conveyance facilities) will not appreciably alter conditions in the action area. Therefore, we conclude that the PA will not have a permanent effect on the recovery of the least Bell's vireo.

9.6.5 Reinitiation Triggers

Some project elements and their effects on least Bell's vireo may change as DWR continues to develop the PA and therefore may require reinitiation if project elements are located in areas that occur in or near modeled habitat and effects rise above those analyzed herein.

9.6.6 Cumulative Effects

The activities described in Section 9.2.5 for delta smelt are also likely to affect least Bell's vireo. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5. are incorporated by reference into this analysis for the least Bell's vireo.

9.6.7 Conclusion

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the least Bell's vireo.

Reproduction

The least Bell's vireo is relatively rare in the action area (Goldwasser *et al.* 1980). Therefore, the PA will not appreciably affect least Bell's vireo reproduction, and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

Numbers

As described in the Reproduction section above, the number of least Bell's vireos in the action area is relatively low, based on recent and past records (Goldwasser *et al.* 1980). Also, Reclamation and DWR have proposed measures to avoid and minimize the effects of the PA on the species. Despite the proposed protection measures, we anticipate the PA may still result in effects to the least Bell's vireo; however, the number of least Bell's vireos affected would be very low. This is especially true relative to the range-wide numbers. Therefore, the PA will not appreciably reduce the number of least Bell's vireos and we conclude the number of least Bell's vireos throughout the species' range would not decline.

Distribution

During migration, least Bell's vireos may stop to rest and forage in variety of vegetation types where construction of water conveyance facilities could be located; the loss of this stop-over habitat will not have a measurable effect on the species.

The number of least Bell's vireos likely to be affected by projects activities will be very low. We do not expect that any least Bell's vireos will be directly killed by construction of the water conveyance facilities, and that very few least Bell's vireos will be affected by the PA activities. We also conclude that least Bell's vireos will continue to survive in the action area regardless of the activities. Consequently, the water conveyance facility construction will not alter the distribution of the least Bell's vireo and we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

Effects on Recovery

For a species like the least Bell's vireo that has lost much of its former known occupied habitat, recovery would necessitate the conservation of much of the remaining habitat that still supports it. Reclamation is proposing to minimize the adverse effects of the loss of suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation has proposed to restore or protect suitable habitat to offset the total loss of suitable habitat. Habitat loss and degradation are contributing factors to the decline of least Bell's vireo; consequently, restoration or protection of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of the least Bell's vireo. Consequently, we conclude that the PA would not interfere with the recovery of the least Bell's vireo.

Conclusion

After reviewing the current status of the least Bell's vireo, the environmental baseline for the action area, the effects of the PA, and the cumulative effects, it is the Service's biological opinion that the construction of the CWF facilities, as proposed, is not likely to jeopardize the continued existence of the species. We have reached this conclusion because:

1. The number of least Bell's vireos likely to be affected by projects activities will be very low.

2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of least Bell's vireos survival and recovery because many more individuals and larger habitat areas outside of the action area will remain.

3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects.

4. Reclamation and DWR propose to restore or protect habitat that could support the least Bell's vireo.

5. The PA is being implemented in a manner that will minimize damage to areas that could support the least Bell's vireo.

6. The PA will result in the relatively minor loss of resting and foraging habitat and therefore will not adversely affect the least Bell's vireo species' ability to migrate through the action area.

9.6.8 Least Bell's Vireo Literature Cited

Barlow, J. C. 1962. Natural history of the Bell vireo, *Vireo bellii*. Audubon. Univ. Kansas Publ. Mus. Nat. Hist. 12:241-296.

Brown, B. T. 1993. Bell's Vireo (Vireo bellii) In: A. Poole, P. Stettenheim, and F. Gill (eds.) The Birds of North America 35. The American Ornithologists' Union. Washington, DC:

California Department of Fish and Wildlife. 2013. California Natural Diversity Database, RareFind 3, Version 3.1.0. June.

Dooling, R.J. and A.J. Popper. 2007. The effects of highway noise on birds. Environmental BioAcoustics LLC.Rockville, MD. September 30, 2007. Prepared for the California Department of Transportation Division of Environmental Analysis, Sacramento, CA.

Franzreb, K. E. 1989. Ecology and Conservation of the Endangered Least Bell's Vireo. U.S. Fish and Wildlife Service Biological Report 89(1).

Gauthreaux, S.A. and C.G. Belser. 2006. Effects of artificial night lighting on migrating birds. Pages 67-93 In: Ecological consequenes of artificial night lighting. C. Rich and T. Longcore (eds.). Island Press.

George, T.L., R.J. Harrigan, J.A. LaManna, D.F. DeSante, J.F. Saracco, and T.B. Smith. 2015. Persistent impacts of West Nile virus on North American bird populations. www.pnas.org/cgi/doi/10.1073/pnas.1507747112.

Goldwasser, S. 1981. Habitat Requirements of the Least Bell's Vireo. California Department of Fish and Game, Job IV-38.1.

Goldwasser, S., D. Gaines, and S. Wilbur. 1980. The Least Bell's Vireo in California: A de facto Endangered Race. American Birds 34:742–745.

Gray, M. V., and J. Greaves. 1984. The Riparian Forest as Habitat for the Least Bell's Vireo (*Vireo bellii pusillus*). Paper presented at the California Riparian Systems Conference, University of California, Davis; September 1981.

Greaves, J.M. 1987. Nest-site tenacity of Least Bell's Vireos. West. Birds 18:50-54.

Hargrove L., P. Unitt, K. Clark, and L. Squires. 2014. Status of riparian bird species in the Coachella Valley, final report. San Diego Natural History Museum. San Diego, California.

Howell, C. A., J. K. Wood, M. D. Dettling, K. Griggs, C. C. Otte, L. Lina, and T. Gardali. 2010. Least Bell's Vireo Breeding Records in the Central Valley Following Decades of Extirpation. Western North American Naturalist 70(1):105–113.

Kus, B. E. 1998. Use of Restored Riparian Habitat by the Endangered Least Bell's Vireo. Restoration Ecology 6:75–82. Cited in Howell, C. A., J. K. Wood, M. D. Dettling, K. Griggs, C. C. Otte, L. Lina, and T. Gardali. 2010. Least Bell's Vireo Breeding Records in the Central Valley Following Decades of Extirpation. Western North American Naturalist 70(1):105–113.

Kus, B. E., and K. L. Miner. 1989. The Use of Non-Riparian Habitats by Least Bell's Vireo (*Vireo bellii pusillus*). Pages 299–303 cited in D. L. Abell (ed.), California Riparian Systems Conference: Protection, Management, and Restoration for the 1990s. 1988 September 22-24, Davis, CA. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA; USDA Forest Service General Technical Report PSW-110.

Kus, B. E. 2002. Least Bell's Vireo (*Vireo bellii pusillus*). In The Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian-Associated Birds in California. California Partners in Flight.http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

Kus, B., S. Howell, R. Pottinger, K. Allen, and M. Madden. 2014. Recent population trends in least Bell's vireos and southwestern willow flycatchers: 2014 Update. San Diego Field Station, Western Ecological Research Center, U.S. Geological Survey. San Diego, California.

McClure1, J.W.C., Watre, H. E. Ware, J. Carlisle, G. Kaltenecker and J.R. Barber. 2013. An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. Proc R Soc B 280: 20132290. http://dx.doi.org/10.1098/rspb.2013.2290

McCreedy, C., and L.S. Warren. 2015. Amargosa Canyon songbird project: 2014 least Bell's vireo and southwestern willow flycatcher report. Point Blue Conservation No. 2020, Point Blue Conservation Science. Petaluma, California. Point Blue Conservation.

Nolan, V., Jr. 1960. Breeding behavior of the Bell vireo in southern Indiana. Condor 62:225-244.

RECON (Regional Environmental Consultants). 1989. Comprehensive species management plan for the least Bell's vireo (Vireo bellii pusillus). Prepared for San Diego Association of Governments, San Diego.

Riparian Habitat Joint Venture. *2004.* The Riparian Bird Conservation Plan: A Strategy for Reversing the Decline of Riparian-associated Birds in California. Version 2.0. California. Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian_v-2.pdf

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and DB. W. Anderson. 1991. Birds of the lower Colorado River valley. Univ. Arizona Press, Tucson, AZ.

Salata, L. 1983. Status of the Least Bell's Vireo on Camp Pendleton, California: Report on Research Done in 1983. Unpublished report. Laguna Niguel, CA: U.S. Fish and Wildlife Service.

(Service) U.S. Fish and Wildlife Service.1986. Determination of Endangered Status for the Least Bell's Vireo. Federal Register 51:16474-16481. May 2, 1986.

(Service) U.S. Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo (*Vireo bellii pusillus*).

(Service) U.S. Fish and Wildlife Service. 2006. Least Bell's vireo (*Vireo bellii pusillus*) 5-year review summary and evaluation. Carlsbad Fish and Wildlife Office. Carlsbad, California.

Personal Communication

Whisler, Edward. July 13, 2015. Email regarding survey effort and results for Least Bells' Vireo in the Yolo Bypass. Williams, D. F. 1988. Ecology and Management of the Riparian Brush Rabbit in Caswell Memorial State Park. California Department of Parks and Recreation, Lodi, CA. Interagency Agreement 4-305-6108.

9.7 San Joaquin Kit Fox

9.7.1 Status of the Species

The Service listed the San Joaquin kit fox (kit fox) as endangered on March 11, 1967 (32 FR 4001). Critical habitat has not been designated for this species. The Service completed a recovery plan for the species on September 30, 1998 (Service 1998) and published a 5-year review of the species on February 16, 2010 (Service 2010). The following paragraphs provide a summary of the relevant information in the recovery plan and 5 year review.

Recovery Plan

The kit fox occurs in nearly all the natural communities of the San Joaquin Valley. Since the species has a broad distribution and requirement for relatively large areas of habitat, it is considered a keystone species and as an umbrella species for the purposes of conservation and recovery of federally-listed species in the valley. The recovery plan identifies of three geographically-distinct core populations, and smaller satellite populations. The recovery plan recognizes that recovery of the species requires a dual track with simultaneous actions, of both: (A) habitat protection and population interchange and (B) population ecology and management. For track A, an important element of the recovery of kit foxes is connecting larger blocks of isolated natural land to core and satellite populations. Connecting large blocks will help reduce the harmful effects of habitat loss and fragmentation. For track B, future studies are needed to help define management actions concerning distribution, habitat utilization and dispersal. The primary goal of the recovery strategy for kit foxes identified in the recovery plan is to establish a complex of interconnected core and satellite populations throughout the species' range.

The latest five review of the species concluded that the kit fox continues to meet the definition of endangered. To delist the species, several additional satellite populations (number dependent on results of track B research) encompassing as much as possible of the environmental and geographic variation of the historic geographic range needs to be established.

The recovery plan identifies the protection of existing kit fox habitat in the northern portion of its range and protection of existing connections between habitat in Contra Costa County and habitat farther south as primary recovery actions.

Habitat

In the San Joaquin Valley before 1930, the range of the kit fox extended from southern Kern County north to Tracy in San Joaquin County, on the west side, and near La Grange in Stanislaus County, on the east side (Grinnell *et al.* 1937; Service 1998). Historically, this species occurred in several San Joaquin Valley native plant communities in the northern portion of their range, kit foxes commonly are associated with annual grassland (Hall 1983) and Valley Oak Woodland (Bell 1994). Kit foxes inhabit grazed grasslands, grasslands with wind turbines, and also live adjacent to and forage in tilled and fallow fields, and irrigated row crops (Bell 1994). Kit foxes use some types of agricultural land where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Jensen 1972, Knapp 1978, Hansen 1988). Kit foxes also den on small parcels of native habitat surrounded by intensively maintained agricultural lands (Knapp 1978), and adjacent to dryland farms (Jensen 1972, Kato 1986, Orloff *et al.* 1986). San Joaquin kit foxes also exhibit a capacity to utilize habitats that have been altered by man. This fox species is present in many oil fields, grazed pasturelands, and "wind farms" (Cypher 2000). Kit foxes can inhabit the margins and fallow lands near irrigated row crops, orchards, and vineyards, and may forage occasionally in these agricultural areas (Service 1998). There are a limited number of observations of kit foxes foraging in trees in urban areas (Murdoch *et al.* 2005). The kit fox seems to prefer more gentle terrain and decreases in abundance as terrain ruggedness increases

(Grinnell *et al.* 1937; Morrell 1972; Warrick and Cypher 1999). Other plant communities in the San Joaquin Valley providing kit fox habitat include Northern Hardpan Vernal Pool, Northern Claypan Vernal Pool, Alkali Meadow, and Alkali Playa.

Overall, kit foxes prefer loose-textured soils (Grinnell *et al*. 1937; Hall 1946; Egoscue 1962, Morrell 1972), but are found on virtually every soil type. Dens appear to be scarce in areas with shallow soils because of the proximity to bedrock (O'Farrell and Gilbertson 1979, O'Farrell *et al.* 1980), high water tables (McCue *et al.* 1981), or impenetrable hardpan layers (Morrell 1972). However, kit foxes will occupy soils with high clay content, such as in the Altamont Pass area in Alameda County, where they modify burrows dug by other animals (Orloff *et al.* 1986).

Threats

The primary threats to the species are: (1) the continued loss of kit fox habitat to agricultural and urban development, (2) the continued threats from pesticide exposure, (3) competitive exclusion by other canids, (4) the highly fluctuating population dynamic of most kit fox populations, (5) the isolation and loss of small subpopulations due to stochastic events and habitat fragmentation, and (6) threats identified since listing, such as off-road vehicle use and loss of prey.

Another threat is vehicle strikes. Little data is available regarding the frequency with which the animals cross roads. The proportion of successful road crossings by these animals likely declines with increasing road size, traffic volume and density, and vehicle speeds. The proportion of kit foxes successfully crossing roads may increase in areas where they obtain more experience crossing roads, such as in and near urban areas. The loss of kit fox to vehicles may constitute a significant population effect within their northern range where they occur in low abundance. Morrell (1970) reported vehicle strikes to be the major cause of death for kit foxes based on study in which 128 of 152 deaths were reportedly caused by automobiles. Within eastern Alameda County, EIP Associates (CNDDB Occ. #585) reported a kit fox along Interstate 205 near the Alameda/San Joaquin County line in 1986; Spencer (CNDDB Occ. #41) reported a single adult running along Kelso Road on June 20, 1992; and Beeman (CNDDB Occ. #39) reported a single adult kit fox crossing Patterson Pass Road on June 23, 1995.

Vehicles constitute a consistent, but variable source of mortality for the animal, based on the frequency with which vehicle strikes occur. Vehicle strikes appear to occur most frequently where roads transverse areas where the animals are abundant. However, the linear quantity of roads in a given area may not be directly related to the number of vehicle strikes in a given area. The type of road (*e.g.*, number of lanes), traffic volume, and average speed of vehicles likely all influence the number of San Joaquin kit fox/vehicle strikes. The number of strikes likely increases with road size, traffic volume, and average speed (Clevenger and Waltho 1999). Also, roads have been documented as barriers to movements by a variety of species, and this effect varies with road size and traffic volume.

Climate Change

Current climate change predictions for terrestrial areas in the northern hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field *et al.* 1999; Cayan *et al.* 2005; Cayan *et al.* 2006; IPCC 2007). Kit fox subpopulations are threatened by both droughts and high rainfall events (Cypher, California State University-Stanislaus, personal communication; Williams, Kern National Wildlife Refuge Complex, personal communication; Williams *et al.* 1993, Rathbun 1998, Germano and Williams 2005). Kit fox subpopulations, including the relatively large subpopulations at the Naval Petroleum Reserves, California and Carrizo Plains areas, demonstrate large fluctuations in abundance in response to weather-mediated prey levels, which increases the potential for these groups to be extirpated (Cypher *et al.* 2000; Bean and White 2000; Bidlack 2007). Weather conditions usually vary over larger landscape scales, leading to the general expectation that drought-mediated decreases in kit fox abundance, or local extirpation of some groups, should not affect persistence of the species as long as healthy core kit fox populations are not limited to one portion of the range. However, the loss and fragmentation of habitat documented herein has reduced the likelihood that lost sites will be re-colonized (Williams 2007; Cypher 2006; Cypher *et al.* 2007), which is expected to result in a cumulative loss of small groupings over time (Clark *et al.* 2007b).

Because of the expected increased frequency of dry weather and droughts, and substantial precipitation events are expected to negatively affect the native prey species upon which the kit fox depends, the Service expects climate change to pose a substantial threat to the species by further exacerbating interannual fluctuations in kit fox reproductive success and abundance. Changes in the distribution of individual plants species could increase or decrease distributions of key species (Kelly and Goulden 2008; Loarie *et al.* 2008), and are expected to affect kit fox. However, the magnitude of these effects is not known at this time.

Population

Historically, kit foxes may have existed in a metapopulation structure of core and satellite populations, some of which periodically experienced local extinctions and recolonization (Service 1998). Today's populations exist in an environment drastically different from the historic one, however, and extensive habitat fragmentation will result in geographic isolation, smaller population sizes, and reduced genetic exchange among populations; all of which increase the vulnerability of kit fox populations to extirpation. Populations of kit foxes are extremely susceptible to the risks associated with small population size and isolation because they are characterized by marked instability in population density. For example, the relative abundance of kit foxes at the Naval Petroleum Reserves, California, decreased 10-fold during 1981 to 1983, increased 7-fold during 1991 to 1994, and then decreased 2-fold during 1995 (Cypher and Scrivner 1992; Cypher and Spencer 1998).

Many populations of kit fox are at risk of chance extinction owing to small population size and isolation. This risk has been prominently illustrated during recent, drastic declines in the populations of kit foxes at Camp Roberts and Fort Hunter Liggett. Captures of kit foxes during annual live trapping sessions at Camp Roberts decreased from 103 to 20 individuals during 1988 to 1991. This decrease continued through 1997 when only three kit foxes were captured (White *et al.* 2000). A similar decrease in kit fox abundance occurred at nearby Fort Hunter Liggett, and only 2 kit foxes have been observed on this installation since 1995 (L. Clark, Wildlife Biologist, Fort Hunter Liggett, personal communication to P. White, Service, Sacramento, February 15, 2000). It is unlikely that the current low abundances of kit foxes at Camp Roberts and Fort Hunter Liggett will increase substantially in the near future owing to the limited potential for recruitment. The chance of substantial immigration is low because the nearest core population on the Carrizo Plain is distant (greater than 16 miles) and separated from these installations by barriers to kit fox movement such as roads, developments, and irrigated agricultural areas. Also, there is a relatively high abundance of sympatric predators and competitors on these installations that contribute to low survival rates for kit foxes and, as a result, may limit population growth (White *et al.* 2000). Hence, these populations may be on the verge of extinction.

The loss and fragmentation of habitat could also eventually lead to reduced genetic variation in populations of kit foxes that are small and geographically isolated. It is likely that northern populations of kit foxes were once panmictic (*i.e.*, randomly mating in a genetic sense), or nearly so, with southern populations. In other words, there were no major barriers to dispersal among populations. Current levels of gene flow also appear to be adequate, however, extensive habitat loss and fragmentation continues to form more or less geographically distinct populations of foxes, which could potentially reduce genetic exchange among them. An increase in inbreeding and the loss of genetic variation could increase the extinction risk for small, isolated populations of kit foxes by interacting with demography to reduce fecundity, juvenile survival, and lifespan (Lande 1988; Frankham and Ralls 1998; Saccheri *et al.* 1998).

An area of particular concern is Santa Nella in western Merced County where pending development plans threaten to eliminate the little suitable habitat that remains and provides a dispersal corridor for kit foxes between the northern and southern portions of their range. Preliminary estimates of expected heterozygosity from kit foxes in this area indicate that this population may already have reduced genetic variation.

Arid systems are characterized by unpredictable fluctuations in precipitation, which lead to high frequency, high amplitude fluctuations in the abundance of mammalian prey for kit foxes (Goldingay *et al.* 1997, White and Garrott 1999). Because the reproductive and neonatal survival rates of kit foxes are strongly depressed at low prey densities (White and Ralls 1993; White and Garrott 1997, 1999), periods of prey scarcity owing to drought or excessive rain events can contribute to population crashes and marked instability in the abundance and distribution of kit foxes (White and Garrott 1999). In other words, unpredictable, short-term fluctuations in precipitation and, in turn, prey abundance can generate frequent, rapid decreases in kit fox density that increase the extinction risk for small, isolated populations.

The long-term viability of each of these core and satellite populations depends partly upon periodic dispersal and genetic flow between them. Therefore, kit fox movement corridors between these populations must be preserved and maintained. In the northern range, from the Ciervo Panoche in Fresno County northward, kit fox populations are small and isolated, and have exhibited significant decline.

There has never been a comprehensive survey of kit foxes or their habitat except for one core population in western Kern County. What is known comes from incidental sightings, local surveys, research projects, and aerial photos. There are more than several hundred recorded sightings of San Joaquin kit foxes in the San Joaquin Valley (CNDDB 2004).

9.7.2 Environmental Baseline

The southern portion of the PA is located within the northern range of the species' current and historical range, as indicated in the map below.

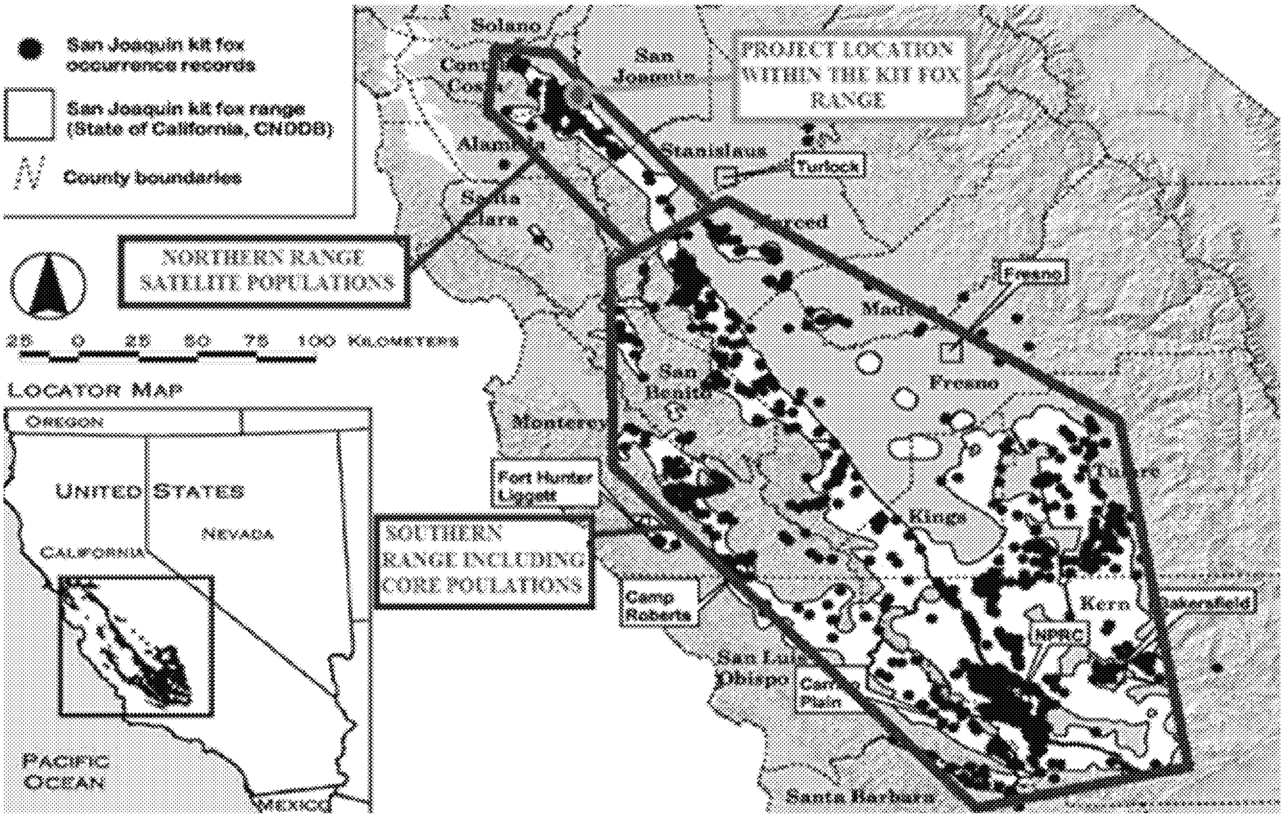

Figure 9.7.2-1. Northern and southern ranges of the San Joaquin kit fox and project location (adapted from the Endangered Species Recovery Program San Joaquin kit fox map, available at http://esrp.csustan.edu/gis/maps/sjkfrange.png).

In January and February 2016, DWR staff completed a habitat analysis for kit fox in the project area and the area immediately adjacent to determine potential utilization by the species. DWR's analysis included onsite and adjacent land vegetation surveys, review of aerials, and review of literature pertaining to habitat requirements. In addition, DWR staff completed an occurrence analysis based on occurrence records, past and present surveys, and best available research.

DWR has identified approximately 60 acres of potential suitable habitat in the action area that overlaps with the construction footprint and associated effects (CWF BA 2016).

The Service has completed numerous section 7 consultations concerning the kit fox in the action area. Some past substantial consultations near the construction footprint include: (1) *Formal Consultation for the Tracy-Livermore Optical Ground Wire Project* (Service File No. 08ESMF00-2012-F-0084-1), and the (2) *Intra-Service Biological Opinion on Issuance of Section 10(a)(B) Incidental Take Permit for the Contra Costa County, the Contra Costa Flood Control and Water Conservation District, the East Bay Regional Park District, and the Cities of Brentwood, Clayton, Oakley, and Pittsburg for Implementation of the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan* (Service File No. 1-1-07-F-2007). These consultations document potential presence of the species and past permanent habitat loss.

According to the 5-year review (Service 2010b), the northern satellite population has declined with no known breeding. The CNDDB reports 24 occurrences of kit fox within Contra Costa County (CDFW 2014) and in 1973, Swick estimated that Contra Costa County supported a population of 123 kit fox but cautioned that this estimate could be high. The most recent kit fox sightings in Contra Costa County include sightings at Vasco Caves (one in May 2001 and one in June 2002) and a single sighting in 2008 in close proximity to the Los Vaqueros Watershed Administrative Offices. Surveys conducted in 2001 and 2002 in Contra Costa County and Alameda Counties in areas identified as having high potential to support kit fox did not find evidence of recent den occupancy by kit fox (Clark *et al.* 2003). Although these results do not demonstrate that kit fox are absent from these areas, they do suggest that kit fox density is low or their occurrence is periodic. Since the PA occurs within the current distribution of the species and within dispersal distance of known occurrences, the Service assumes presence of the species within the action area.

9.7.3 Effects of the Proposed Action

There is potential for kit fox to be present within the action area and the construction footprint during the duration of the PA, due to accessibility of the construction footprint from suitable habitat in the Bryon Hills area in Contra Costa County, California. A known historical northern satellite population is located there, as discussed in the *Environmental Baseline* section for this species. The activities in the PA expected to have effects on kit fox and its suitable habitat include: the geotechnical explorations, the CCF modification, and the power supply and grid connections. Activities included in the PA that are unlikely to affect the species, since those activities have not been identified by DWR to overlap with suitable habitat for the kit fox include: the safe haven work areas, north Delta intakes, tunnel conveyance facilities, placement of the reusable tunnel material, and the HORG. The activities identified above to have effects on this species will be caused by driving overland, access routes, equipment storage, vegetation clearing, pile driving, excavation, dredging, cofferdam installation, new embankments, utilization of heavy equipment, construction of electric transmission lines, construction of substations, and relocation of electric transmission lines.

Construction Activities

The PA will adversely affect the kit fox through harassing and harming (*i.e.*, permanent habitat loss) individuals inhabiting and/or dispersing through habitat within the action area and construction footprint. Kit foxes could be attracted to construction footprint due to the increased availability of cover (*e.g.*, within pipes, trenches, or materials staging areas) or the increased availability of forage items such as food scraps and trash, increasing their risk of injury. Kit fox near the construction footprint are expected to experience harassment resulting from increased levels of human disturbance and vehicle use and excavation of dens and burrows. These activities could displace kit fox which will make them vulnerable to increased predation, exposure, starvation, or stress through disorientation, loss of shelter, and intraspecific and interspecific aggression. The disturbance caused by the PA resulting from construction noise, nighttime illumination, vibration, odors, and human activity can interfere with sensory perception of kit fox, decreasing their ability to locate prey, pups, or mates, or detect approaching predators. Disturbance can induce stress which can alter normal behaviors. The resulting effects can lead to increased energetic requirements, decreased reproductive success and immunological functions, altered temporal or spatial use patterns, displacement, and in some cases death. Responses to external stresses vary among individuals, causing some animals to be more affected than others; however, it is unknown whether disturbance results in reduced local abundance.

Kit foxes in habitat that overlaps with the transmission line right-of-way, along with helicopter work areas (*i.e.*, take-off and landing areas) may be subject to harassment from the noise and propeller wash of low flying helicopters. While kit fox could also be injured or killed by construction vehicles, the proposed vehicle speed limits are likely to avoid collisions with kit foxes. Effects on the kit fox are expected to be greater during the den selection, gestation, and the early rearing period of the breeding cycle (December through July) than at other times of the year.

Increased Noise

The increase in ambient noise resulting from construction of the PA could reduce the ability of kit fox to hear prey, vocalize to other individuals in the area, or reduce ability to detect predators. Noise disturbance may temporarily impair behavioral patterns of this species' prey. It is expected that effects will be amplified during nighttime construction, since the kit fox is a nocturnal mammal. DWR has stated that ambient baseline noise levels are expected to be near 40 dBA (CWF BA 2016- Appendix 6.B). While kit fox in the action area and near or within the construction footprint currently experience noise disturbance from Bryon Highway, railroad, Bryon Airport and road traffic, construction-related effects are expected to increase noise levels for the duration of the construction (*i.e.,* 6 years). All construction activities will increase ambient noise levels in surrounding areas, approximately 4000-5000 ft from the point source (CWF BA 2016- Appendix 6.B). For example, the construction of the divider wall, embankment, and siphons at CCF will all require pile driving, in combination with the six loudest pieces of construction equipment, noise at these construction areas could reach 60 dBA at up to 2,000 ft from the edge of the footprint and up to 4000 to 5000 ft before noise attenuates to baseline conditions (CWF BA 2016 & Appendix 6.B). DWR has proposed measures to minimize to the greatest extent practicable noise resulting from geotechnical explorations in or adjacent to kit fox habitat.

Increased Night Lighting

Increased nighttime illumination of kit fox habitat will occur from lighting required for nighttime construction. The adverse effects of artificial lighting on nocturnal mammals, such as kit fox, include: foraging patterns changes, predation risk increases, biological clock disruptions, road mortality increases, and disruption of dispersal movements through artificially lit landscapes (Rich and Longcore 2006). DWR did not quantify the amount of acreage that could be affected by the increase in night lighting associated with the PA. DWR has proposed measures to minimize nighttime lighting resulting from PA construction in or adjacent to kit fox habitat.

Potential for Vehicle Strikes

Existing roads that will be utilized are identified in the CWF BA and DWR has stated that effects of driving overland will be confined to the construction footprint. Kit foxes utilize habitat along rural roads and highways near the action area, increasing their susceptibility to mortality or injury caused by vehicle strikes. DWR has proposed to minimize these effects by enforcing a daytime speed limit of 20-mph throughout the worksite, where it is practical and safe to do so, except on county roads and State and Federal highways; also, vehicles will observe a nighttime speed limit of 10-mph throughout kit fox habitat within the action area. Based on these measures, no kit fox are expected to be struck by vehicles as a result of the PA.

Temporary Habitat Loss

Some areas will be temporarily denuded, manipulated, or otherwise modified from their pre-project conditions, thereby removing one or more essential habitat components as a result of project activities including construction, staging, storage, lay down, vehicle access, and parking. Temporary effects must be restored to baseline habitat values or better within one year following initial disturbance. DWR proposes to restore habitat affected by geotechnical explorations and the construction of the power supply and grid connections to pre-project conditions. DWR estimates the geotechnical explorations will temporarily affect 2 acres and the power supply and connections will temporarily affect 9 acres. Upon completion of the PA, restoration of affected suitable habitat that is subject to temporary ground disturbances (*e.g.*, construction areas, storage and staging areas, and temporary roads) will be accomplished by recontouring to pre-project elevations and revegetating with native vegetation seed mixture within one year of disturbance, in order not to be considered a permanent loss of habitat. Any future vegetation management that may affect the restored habitat would require reinitiation of this BiOp.

To minimize effects of the geotechnical investigation, work will only occur during the day, work will be monitored by a Service-approved monitor, all holes deeper than 2 ft will be covered, pipes and culverts bigger than 4 inches will be inspected prior to daily construction activity by a Service-approved biologist. To minimize the effects of the power supply and connections prior to final alignments, there will be a pre-construction survey by a Service-approved biologist and if occupied dens are observed, the Service will be notified and alignment will be designed to avoid the den by at least 200 ft. Once the alignment has been finalized, all proposed conservation measures will be followed.

Compensation and Minimization of Effects

DWR proposes to compensate for permanent habitat loss by purchasing habitat prior to impacts within the Byron Hills area, where there is connectivity to existing protected habitat and to other adjoining kit fox habitat, at a ratio of 3:1 and at locations subject to Service-approval. The compensation habitat will be preserved and managed in-perpetuity with a Service-approved conservation easement and a long-term management plan with appropriate funding mechanism. DWR expects the PA will result in 47 acres of permanent habitat loss; therefore, 141 acres of habitat will be protected. Preservation of high value habitat in the Byron Hills area will allow for the permanent protection, long-term management, and enhancement of the habitat for the kit fox, which will contribute to the recovery of this species. Compensation habitat features must be contiguous patches of unprotected grassland habitat connected to existing habitat that is protected under the East Contra Costa County HCP/NCCP.

Other proposed conservation measures outlined in the CWF BA include requiring a qualified Service-approved biologist to conduct pre-construction surveys; educating workers about the presence of kit fox, their habitat, identification, regulatory laws, and avoidance measures; erecting deterrent fencing to minimize the likelihood of kit foxes entering the construction area; covering all steep-walled holes or trenches more than 2 ft deep at the end of each workday; disposing of all food-related trash items in closed containers and removing from the action area weekly; inspecting all den-like structures such as pipes or culverts prior to being buried, capped or moved; restricting the presence of firearms within the action area to law enforcement personnel; prohibiting bringing domestic animals to the action area; all use of rodenticides and herbicides will be prohibited in San Joaquin kit fox habitat; and finally the Service's 2011 *Standardized Recommendations for Protection of the San Joaquin kit fox prior to or during Ground Disturbance* will be implemented for dens. All of these measures will minimize or avoid kit fox from being injured or killed as a result of exposure to construction activities.

9.7.4 Effects to Recovery

The PA would not increase the threats currently impacting the kit fox core or satellite areas as identified in the recovery plan, as described in the *Status of the Species*, or preclude implementation of recovery actions. The resulting adverse effects of the PA's construction footprint are considered permanent due to duration of construction, proposed structures and ongoing operations and maintenance. The suitable habitat affected is outside of the core recovery areas; therefore, with implementation of the proposed conservation measures, the PA is expected to result in minimal change in population numbers and distribution. DWR has proposed to minimize the adverse effects of the loss of individuals and habitat by implementing conservation measures to promote the recovery of the kit fox in a manner where the mitigation is commensurate with the adverse effect. DWR has proposed to restore or create 141 acres of habitat to offset the total loss of individuals predicted for the life of the PA. As stated previously, habitat loss and degradation are contributing factors to the decline of kit fox; consequently, the proposal to create or restore additional 141 acres of habitat is a reasonable means of minimizing the adverse effects of the loss of individuals on the species as a whole and may benefit the recovery of the kit fox.

9.7.5 Reinitiation Triggers

Some project elements and their effects on the San Joaquin kit fox may change as DWR continues to develop the PA and may require reinitiation if effects rise above those analyzed herein. For the San Joaquin kit fox, these elements may include: any long-term vegetation management associated with the power and supply grid, if the effects of construction vehicle-strikes are not fully avoided, and if the Service-approved biologist during pre-construction surveys of the construction footprint or adjacent area identifies additional suitable kit fox habitat that could be affected but not analyzed in this BiOp.

9.7.6 Cumulative Effects

The activities described in Section 9.2.5 for delta smelt are also likely to affect San Joaquin kit fox. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5. are incorporated by reference into this analysis for the San Joaquin kit fox.

9.7.7 Conclusion

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the San Joaquin kit fox.

Reproduction

The action area is located within the portion of the range believed to support a northern satellite population. According to the 5-year review (Service 2010b), this northern satellite population has declined with no known breeding. Therefore, the PA will not appreciably affect San Joaquin kit fox reproduction range-wide, and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

Numbers

The number of individuals affected by the PA will be very low relative to the range-wide numbers. This northern satellite population is thought to be small, evidenced by the lack of dens. Therefore, the PA will not appreciably reduce the number of San Joaquin kit fox.

Distribution

The habitat within the action area is near the northern extent of their range. We do not anticipate that the range-wide distribution of the San Joaquin kit fox will be reduced because it will not eliminate or significantly reduce the distribution of the species. The effect to the species from habitat loss and fragmentation will be minimized by the proposed compensatory mitigation measures. Therefore, we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

Effects on Recovery

Reclamation and DWR propose to minimize the adverse effects of the loss of suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation and DWR have proposed to restore or protect suitable habitat to offset the total loss of suitable habitat. Habitat loss and degradation are contributing factors to the decline of San Joaquin kit fox; consequently, restoration or protection of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of this species. Consequently, we conclude that the PA would not appreciably reduce the likelihood of recovery of the San Joaquin kit fox.

Conclusion

After reviewing the current status of the San Joaquin kit fox, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the PA is not likely to jeopardize the continued existence of the San Joaquin kit fox. We have reached this conclusion because:

1. The number of San Joaquin kit fox likely to be affected by project activities will be low.

2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of survival and recovery of the species range-wide because the majority of individuals and larger habitat areas outside of the action area will remain.

3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects, including compensatory mitigation measures.

4. Reclamation and DWR propose to restore or protect habitat that could support the species.

5. The project is being implemented in a manner that will minimize or avoid effects to the San Joaquin kit fox.

9.7.8 San Joaquin Kit Fox Literature Cited

Bell, H. M. 1994. Analysis of habitat characteristics of San Joaquin kit fox in its northern range. Master Thesis. California State University Hayward, California.

Bean, E. and P.J. White. 2000. Estimation of the abundance of San Joaquin kit foxes on the Carrizo Plain National Monument using distance sampling. Report submitted to Sacramento U.S. Fish and Wildlife Service. 12 pp.

Bidlack, A. 2007. Mesocarnivore responses to changes in habitat and resource availability in California. Ph.D. Dissertation. University of California, Berkeley. California.

(CNDDB) California Department of Fish and Game, Natural Diversity Data Base. 2004.

Cayan, D. 2005. Northern Hemisphere Spring Warming During the Past Five Decades: Links to Snow Cover Losses. Presented at 16th Conference on Climate Variability and Change. Scripps Institute of Oceanography, University of California, San Diego, January 13, 2005.

Cayan, D., A.L. Luers, M. Hanemann, G. Franco, and B. Croes. 2006. Scenarios of Climate Change in California: An Overview. California Energy Commission, PIER Energy Related Environmental Research. CEC-500-2005-186-SF. http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF.

Cayan, D., E. P. Maurer, M. D. Dettinger, M. Tyree, and K. Hayhoe. 2008. Climate change scenarios for the California region. Climatic Change 87 (Suppl 1):S21-S42.

Clark, Jr., H. O., D. A. Smith, B. L. Cypher, and P. A. Kelly. 2003. Detection dog surveys for San Joaquin kit foxes in the northern range. Prepared for Pacific Gas & Electric Company Technical and Ecological Services, San Ramon, CA.

Clark, H.O., R.R. Duke, M.C. Orland, R.T. Golightly, and S.I. Hagen. 2007. The San Joaquin kit fox in North-Central California: a review. Transactions of the Western Section of the Wildlife Society 43:27-36.

Clevenger, A.P. and N. Waltho. 1999. Dry Drainage Culvert Use and Design Considerations for Small- and Medium-Sized Mammal Movement Across a Major Transportation Corridor. Pp. 263-277 In G.L. Evink, P. Garrett, and D. Zeigler (eds.) Proceedings of the Third International Conference on Wildlife Ecology and Transportation. FL-ER-73-99. Florida Department of Transportation, Tallahassee, Florida.

Cypher, B.L. 2000. Effects of roads on San Joaquin kit foxes: a review and synthesis of existing data. Endangered Species Recovery Program, Fresno, California, 59 pp.

Cypher, B.L. 2006. Kit fox conservation in the San Luis Drainage Study Unit. Unpublished report to the U.S. Bureau of Reclamation South-Central California Area Office. California State University, Stanislaus, Endangered Species Recovery Program. Fresno, California.

Cypher, B.L., S.E. Phillips, and P.A. Kelly. 2007. Habitat suitability and potential corridors for San Joaquin kit fox in the San Luis Unit, Fresno, Kings, and Merced Counties, California. Prepared for the U.S. Bureau of Reclamation, South-Central California Area Office, and the U.S. Fish and Wildlife Service.

Cypher, B. L., and Scrivner, J. H. 1992. Coyote control to protect endangered San Joaquin kit foxes at the Naval Petroleum Reserves, California. Pp. 42-47 In: J.E. Borrecco and R. E. Marsh (eds.). Proceedings of the 15th Vertebrate Pest Conference, March 1992, Newport Beach, California. University of California, Davis, California.

Cypher, B. L., and Spencer, K.A. 1998. Competitive interactions between coyotes and San Joaquin kit foxes. J. Mammalogy 79:204-214.

Egoscue, H.J. 1962. Ecology and life history of the kit fox in Tooele County, Utah. Ecology 43:481-497.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC

Frankham, R., and K. Ralls. 1998. Inbreeding leads to extinction. Nature 241:441-442.

Germano, D.J., and D.F. Williams. 2005. Population ecology of blunt-nosed leopard lizards in high elevation foothill habitat. Journal of Herpetology 39:1-18.

Grinnell, J., J.S. Dixon, and J.M. Lindsdale. 1937. Fur-bearing mammals of California; Vol. 2. University of California Press, Berkeley, California.

Goldingay, R.L., P.A. Kelly, and D.F. Williams. 1997. The kangaroo rats of California: endemism and conservation of keystone species. Pacific Conservation Biology 3:47-60.

Hall, E.R. 1946. Mammals of Nevada. Univ. California Press, Berkeley, 710 pp.

Hall, H.M. 1983. Status of the kit fox at the Bethany wind turbine generating (WTC) project site, Alameda County, California. California Department of Fish and Game, Sacramento, California.

Hansen, R.B. 1988. Porterville urban area boundary biotic survey. Unpubl. Rep., Hansen's Biological Consulting, Visalia, CA, 219 pp.

(IPCC) Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press, Cambridge, UK. http://www.ipcc.ch//publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm

Jensen, C.C. 1972. San Joaquin kit fox distribution. U.S. Fish and Wildlife Service, Sacramento, California, Unpublished Report, 18 pp.

Kelly, A.E. and M.L. Goulden. 2008. Rapid shifts in plant distribution with recent climate change. Proceedings of the National Academy of Sciences 105:11823-11826.

Loarie, S.R., B.E. Carter, K. Haydoe, S. McMahon, R. Moe, C.A. Knight, D.D. Ackerly. 2008. Climate change and the future of California's endemic flora. PloS ONE 3(6): e2502 doi: http://dx.doi.org/10.1371/journal.pone 0002502.

Kato, T.T. 1986. Survey of potential habitat for the endangered San Joaquin kit fox (*Vulpes macrotis mutica*), in the Carrizo Plain, San Luis Obispo County, California. Rep. No. EGG 10282-2124, EG&G Energy Measurements, Goleta, CA, 24 pp. + Appendix.

Knapp, D.K. 1979. Effects of agricultural development in Kern County, California, on the San Joaquin kit fox. In 1977 Final Report, Project E-1-1, Job V-1.21, Non-game Wildlife Investigations, California Department of Fish and Game, Sacramento, California, 48 pp.

Lande, R. 1988. Genetics and demography in biological conservation. Science 241:1455-1460.

Longcore, T., and Rich, C. (eds.). 2006. Ecological consequences of artificial night lighting (pp. 413-430). Washington, DC: Island Press.

McCue, P.M., T. Kato, ML. Sauls, and T.P. O'Farrell. 1981. Inventory of San Joaquin kit fox on land proposed as phase II, Kesterson Reservoir, Merced County, California. Report Number EGG 1183-2426, EG&G Energy Measurements, Goleta, CA, 16 pp.

Morrell, S. H. 1970. Life history study of the San Joaquin kit fox. California Department of Fish and Game, Federal Aid in Wildlife Restoration Project W-54R-2. Sacramento, California.

Morrell, S. H. 1972. Life history of the San Joaquin kit fox. California Department of Fish and Game 58:162-174.

Murdoch, J. D., K. Ralls, and B. Cypher. 2005. Two Observations of Tree Climbing by the San Joaquin Kit Fox. Southwest Naturalist 49:522-525.

O'Farrell, T. P. and L. Gilbertson. 1979. Ecological life history of the desert kit fox in the Mojave Desert of southern California. Final Report. Bureau of Land Management, Riverside, California.

O'Farrell, T. P., T. Kato, P. McCue, and M. L. Sauls. 1980. Inventory of San Joaquin kit fox on Bureau of Land Management lands in southern and southwestern San Joaquin Valley. Final Report. EG&G, U.S. Department of Energy, Goleta, California. EGG 1183-2400.

Orloff, S., L. Spiegel, and F. Hall. 1986. Distribution and habitat requirements of the San Joaquin kit fox in the northern extreme of its range. Trans. Western Section, The Wildlife Society 22:60-70.

Rathbun, G.B. 1998. Rodent trapping summary: Carrizo Plain Natural Area. Prepared for the California Department of Fish and Game. Unpublished annual report.

Saccheri, I., M. Kuussaari, M. Kankare, P. Vikman, W. Fortelius, and I. Hanski. 1998. Inbreeding and extinction in a butterfly population. Nature 392:491-494.

(Service) U.S. Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. Region 1, Portland, Oregon, 319 pp.

(Service) U.S. Fish and Wildlife Service. 2010. San Joaquin Kit Fox (*Vulpes macrotis mutica*) 5-Year Review: Summary and Evaluation. Sacramento, California.

Warrick, G.D., and B.L. Cypher. 1998. Factors affecting the spatial distribution of San Joaquin kit foxes. J. Wildlife Management, 62:707-717.

White, P.J., and RA. Garrott. 1997. Factors regulating kit fox populations. Canadian J. Zoology 75:1982-1988.

White, P.J., and RA. Garrott. 1999. Population dynamics of kit foxes. Canadian J. Zoology 77:486-493.

White, P.J., and K. Ralls. 1993. Reproduction and spacing patterns of kit foxes relative to changing prey availability. J. Wildlife Management 57:861-867.

White, P.J., W.H. Berry, J.J. Eliason, and M.T. Hanson. 2000. Catastrophic decrease in an isolated population of kit foxes. Southwest Naturalist 45(2):204-211.

Williams, D.F., D.J. Germano, and W. Torcioffill. 1993. Population studies of endangered kangaroo rats and blunt-nosed leopard lizards in the Carrizo Plain Natural Area, California. California Dept. Fish and Game, Nongame Bird and Mammal Section, Report 93-01:1-114.

Personal Communication

Clark, L. 2000. Wildlife Biologist, Fort Hunter Liggett, San Luis Obispo County, California personal communication to P. White, Fish and Wildlife Service, Sacramento, February 15, 2000

Cypher, Brian. 2007 Electronic mail from Biologist, Endangered Species Recovery Program, California State University-Stanislaus, Bakersfield, California, to Joseph Terry, Fish and 96 Wildlife Biologist, San Joaquin Valley Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, California.

Williams, Pam. 2007. Electronic mail from Refuge Biologist, Kern National Wildlife Refuge Complex, Delano, California to Joseph Terry, Biologist, San Joaquin Valley Branch, Endangered Species Division, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Sacramento, California.

9.8 <u>Valley Elderberry Longhorn Beetle</u>

9.8.1 Status of the Species

The valley elderberry longhorn beetle was listed as threatened throughout its range and critical habitat was designated on August 8, 1980 (45 FR 52803-52807). Critical habitat for the valley elderberry longhorn beetle does not occur within the action area; therefore, it will not be addressed further in this BiOp.

The status of the valley elderberry longhorn beetle have been assessed in the *Recovery Plan Valley Elderberry Longhorn Beetle* (Service 1984) (Recovery Plan) and the 5-year review (Service 2006). For the most recent comprehensive assessment of the range-wide status of the valley elderberry longhorn beetle, refer to the *Withdrawal of the Proposed Rule To Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife* (Service 2014; 79 FR 55874) (withdrawal notice).

In 2012, the Service recommended the delisting of the valley elderberry longhorn beetle (77 FR 60238). The proposal to delist the valley elderberry longhorn beetle was withdrawn on September 17, 2014 (79 FR 55874), and further analysis has resulted in a range modification for the species (Environmental Conservation Online System (ECOS) 2016), and prompted the Service to develop a new Framework for Assessing Impacts (Service 2017).

Threats, such as the loss of riparian habitat due to development, infrastructure construction and land conversion to agriculture, and the effects of nonnative invasive species were evaluated during the review and discussed in the final withdrawal notice, and continue to act on the valley elderberry longhorn beetle since the withdrawal notice was published. These factors have greatly contributed to the loss and fragmentation of the valley elderberry longhorn beetle metapopulations, including the construction of roads and pipelines. Habitat loss continues to exacerbate the highly fragmented distribution of the valley elderberry longhorn beetle. Direct habitat loss irreversibly damages riparian habitat, specifically to elderberry (*Sambucus* spp.) shrubs. The alteration and loss of habitat surrounding riparian habitat may disrupt the physical processes conducive to functional riparian ecosystems and further fragment the habitat.

Reproduction and Habitat Requirements

Valley elderberry longhorn beetle is endemic to moist valley oak riparian corridors in the lower Sacramento and San Joaquin valleys (Service 1984). The valley elderberry longhorn beetle is closely associated with elderberry, as these plants are an obligate host plant for larvae and are necessary for the completion of the life cycle (Eng 1984; Barr 1991; Collinge *et al*. 2001). The two main species of elderberry used by this species are the blue elderberry (*Sambucus nigra* subsp. *caerulea,* formerly *S. mexicana*) and red elderberry (*S. racemosa*). Blue elderberry is a component of riparian habitats throughout the Central Valley. Although this shrub occasionally occurs outside riparian areas, shrubs supporting the greatest beetle densities are located in areas where the shrubs are abundant and interspersed in significant riparian zones (Talley *et al.* 2006).

Adult valley elderberry longhorn beetles live for a few days to a few weeks between mid-March and mid-May, and are most active from late April to mid-May. The adult beetles feed on the elderberry foliage and possibly its flowers. During this time of activity, the beetles mate, and the female lays eggs on the living elderberry plant host. The eggs are typically placed individually or in small clusters within crevices in the bark or junctions of the stem and trunk or leaf petiole and stem. Eggs hatch within a few days and soft-bodied larvae emerge. The larvae are on the surface of the elderberry from a few minutes to several hours or a day and then bore to the center of the elderberry stems where they create a feeding gallery in the pith at the center of the stem. The larvae develop for 1 to 2 years feeding on pith. The late instar larvae chew through the inner bark, all or most of the way to the surface, then return inside plugging the holes with wood shavings. The larvae move back down the feeding gallery to an enlarged pupal chamber packed with frass. Here the larvae metamorphose into pupae between December and April (Talley *et al.* 2006).

The length of pupation is thought to be about one month with the emergent adult remaining in the chamber for up to several weeks. Adults complete the hole in the outer bark and emerge during the flowering season of elderberry shrubs. The exit holes are circular to oval and range in size from 4 to 10 millimeters in diameter (Talley *et al.* 2006).

Numbers

In the withdrawal notice, we reevaluated the valley elderberry longhorn beetle occurrence records, location, and occupancy data described in our proposed rule, and incorporated new information received since the proposed delisting rule was published (77 FR 60238). The valley elderberry longhorn beetle is a habitat specialist, with limited dispersal ability and a short adult lifespan, and is found in low numbers within a population structure that has become fragmented within its historical range, and continues to be fragmented further by ongoing impacts to its habitat. The valley elderberry longhorn beetle's vulnerable developmental stages (*i.e.*, exposure of eggs and larvae) and its rarity (*i.e.*, low local numbers, low occupancy within its range) are important elements of the metapopulation structure of the species. We concluded that there are extant occurrences of the valley elderberry longhorn beetle at 36 geographical locations in the Central Valley (these locations are based in large part on observations of exit holes, which may not be an accurate depiction of occupancy). However, we acknowledge that there are no current estimates of population size or trends in population numbers for the valley elderberry longhorn beetle.

Distribution

In the withdrawal notice, we reevaluated all available spatial data and provided an updated historical distribution map based on surveys conducted since 1997. We also described the species' distribution in the context of a metapopulation structure and fragmented habitat. The valley elderberry longhorn beetle remains localized in its distribution (low local numbers within a population structure), with limited dispersal ability, and we estimate it occupies less than 25% of the remaining elderberry habitat found within fragmented riparian areas. There has been nearly 90 percent loss of riparian vegetation in the Central Valley, and the fragmentation of this habitat that has resulted in a locally uncommon or rare and patchy distribution (clustered in regional aggregations) of the valley elderberry longhorn beetle within its remaining presumed historical range in the Central Valley (patchy distribution from Tehama County to Fresno County).

9.8.2 Environmental Baseline

The current distribution of valley elderberry longhorn beetle in the action area is largely unknown. There are only three reported occurrences of valley elderberry longhorn beetle in the action area, including one along Middle River north of Tracy and two occurrences along small drainages between the Sacramento River and the Sacramento Deepwater Ship Channel in the vicinity of West Sacramento (CDFW 2013). There are additional historical occurrences from along the Sacramento River corridor and Putah Creek in Yolo County (Jones & Stokes 1987; Service 1984; Barr 1991; Collinge *et al.* 2001). Comprehensive surveys for the species or its host plant, elderberry, have not been conducted and thus the population size and location of the species in the action area is unknown. Distribution is typically based on the occurrence of elderberry shrubs, which are known to occur along riparian corridors throughout the action area, including the Sacramento River, Stanislaus River, San Joaquin River, and along smaller natural and channelized drainages, as well as in upland habitats.

9.8.3 Effects of the Proposed Action

Direct effects are the effects of the PA that directly affect the species; for example, those actions that immediately destroy or adversely affect habitat or displace animals and plants. Individual valley elderberry longhorn beetles and their larvae may be directly injured or killed by actions leading to the loss of habitat (*i.e.*, the killing of or damage to elderberry plants) in which they live. The Service views that any ground disturbance within 20 ft of the dripline of an elderberry plant has the potential to adversely affect that plant and may cause mortality.

Indirect effects are caused by or result from a proposed action, are later in time, and are reasonably certain to occur. Implementation of conservation measures will minimize indirect effects that may occur outside of the 20 ft buffer around an elderberry plant. Elderberry shrubs may be indirectly affected by actions occurring within 100 ft of the of the elderberry plant's dripline. These may include dust accumulating on plants, soil compaction, inappropriate herbicide, and fuel spills.

The life cycle of the valley elderberry longhorn beetle is such that it may be impossible to know whether an elderberry plant is occupied by larvae or not. Without visual verification of adult valley elderberry longhorn beetles being present, the only other indication of occupation is the presence of exit holes in the stems of elderberry shrubs. The presence of exit holes in elderberry shrub stems does translate to a higher likelihood that the shrubs in the general area are occupied, but the lack of exit holes does not indicate a lack of presence of the valley elderberry longhorn beetle. For that reason, the Service assumes that any elderberry plant within the range of the valley elderberry longhorn beetle might be occupied by larvae.

Elderberry shrubs within riparian and grassland habitats within the action area have the potential to provide habitat for valley elderberry longhorn beetles and all suitable habitat is presumed occupied. It was not possible to do field surveys of the entire action area for the valley elderberry longhorn beetle because many of the properties are in private ownership. Therefore, suitable modeled habitat was used to identify areas of potential effect. The model used vegetation types and associations from various data sets to map the distribution of suitable valley elderberry longhorn beetle habitat in the action area (CWF BA 2016). The following assumption was used:

Assumption: Valley elderberry longhorn beetle habitat in the action area is restricted to certain areas and vegetative types.

Rationale: The model identifies habitat for the valley elderberry longhorn beetle as locations where the elderberry shrub is expected to be found in the action area and designates additional habitat as grasslands within 200 ft of streams. Elderberry shrubs are unevenly distributed along riparian corridors and adjacent upland habitats and in some areas may be lacking entirely. Thus, the model conservatively estimates the extent of suitable habitat for valley elderberry longhorn beetle. Elderberry shrubs also occur incidentally along fence rows and in a variety of other disturbed conditions, particularly where birds may congregate and deposit seeds. The model does not include these incidental habitat areas and, thus, in this respect may underestimate the distribution of potential habitat (*i.e.*, elderberry shrubs) for the valley elderberry longhorn beetle in the action area.

Water Conveyance Facility Construction-Habitat Loss

Activities associated with water conveyance facility construction that could adversely affect valley elderberry longhorn beetles in the form of mortality, harm and harassment include: the NDD, tunneled conveyance facilities, RTM, CCF, HORG, safe haven work areas, geotechnical explorations, and power supply and grid connections. These construction activities may affect valley elderberry longhorn beetles. Water conveyance facility construction is estimated to last 12 to 15 years.

According to Reclamation and DWR, implementation of the PA will result in the permanent loss of 277.76 acres of modeled valley elderberry longhorn beetle habitat that is assumed to be occupied. Affected habitats include riparian and elderberry savanna grassland within the action area (Table 9.8.3-1).

Table 9.8.3-1. Permanent loss of modeled valley elderberry longhorn beetle habitat.

Valley Elderberry Longhorn Beetle Modeled Habitat	Permanent Habitat Loss						
	Safe Haven Work Areas	North Delta Intakes	Tunneled Conveyance Facilities	Clifton Court Forebay	Head of Old River Gate	Reusable Tunnel Material	Total
Grassland within 200 ft	1	31	57	73.51	1	65	226.51
Riparian Habitat	1	14	19	1.25	0	14	49.25
Total Acres	**2**	**45**	**76**	**74.76**	**1**	**79**	**277.76**

Implementation of the PA will also result in the temporary loss of 106 acres of modeled valley elderberry longhorn beetle habitat. Affected habitats include riparian and elderberry savanna grassland within the action area (Table 9.8.3-2).

Table 9.8.3-2. Temporary Loss of Modeled Valley Elderberry Longhorn Beetle Habitat

Valley Elderberry Longhorn Beetle Modeled Habitat	Temporary Habitat Loss		
	Geotechnical Exploration	Power Supply and Connection	Total
Grassland within 200 ft	52	35	87
Riparian Habitat	11	8	19
Total Acres	**63**	**43**	**106**

Reclamation and DWR have proposed habitat preservation, creation, and enhancement that will minimize the effects of habitat loss on valley elderberry longhorn beetle (Table 9.8.3-3). This land will be protected and managed for the conservation of the species in perpetuity prior to impacts. The protected lands will provide habitat for breeding, feeding and sheltering commensurate with or better than habitat lost as a result of the PA. These lands will help maintain the geographic distribution of the species and will contribute to the recovery of the species by increasing the amount of habitat that is secure from development threats and the other factors that threaten the species that can be addressed by habitat protection and management.

Table 9.8.3-3. Compensatory mitigation for effects to valley elderberry longhorn beetle*.

Location of Affected Plants	Stems (max diameter at ground level) of affected plants		Exit holes (Yes/No, and number)[1]		Elderberry seedling ratio[2]	Associated natives ratio[3]	Elderberry seedling total[4]	Associated native total[4]
Non-riparian (25 shrubs; 500 stems)	≥1inch, <3 inches	280	No	151	1:1	1:1	151	151
			Yes	129	2:1	2:1	258	516
	≥3 inches <5 inches	115	No	62	2:1	1:1	124	124
			Yes	53	4:1	2:1	212	424
	≥5 inches	105	No	57	3:1	1:1	170	170
			Yes	48	6:1	2:1	291	582
Riparian (58 shrubs; 1,058 stems)	≥ 1 inch, <3 inches	709	No	348	2:1	1:1	696	348
			Yes	361	4:1	2:1	1,444	722
	≥3 inch, <5 inches	179	No	86	3:1	1:1	258	86
			Yes	93	6:1	2:1	558	186
	≥5 inches	170	No	84	4:1	1:1	336	84
			Yes	86	8:1	2:1	688	172
Total							**5,186**	**3,565**

* Does not include effects of CCWD; no information on numbers for elderberry stems provided.

[1] Presence of exit holes indicating valley elderberry longhorn beetle. All stems measuring one inch or greater in diameter at ground level on a single shrub are considered occupied when exit holes are present anywhere on the shrub.

[2] Ratios in this column correspond to the number of cuttings or seedlings to be planted per elderberry stem (one inch or greater in diameter at ground level) as described in the 1999 Valley Elderberry Longhorn Beetle Conservation Guidelines.

[3] Ratios in this column correspond to the number of associated native species to be planted per elderberry seedling or cutting planted.

[4] Numbers of elderberry seedlings and associated native plants are the required numbers of plantings for compensation if impacts on all 83 shrubs occur. Total seedlings/cuttings and associated natives = **13,823**

83 transplants (plus 830 seedlings/cuttings and natives) x 1,800 sq ft = 149,400 sq ft = 3.43 acres

7,921 remaining seedlings/cuttings and natives at 10 per 1,800 sq ft = 1,425,780sq ft = 32.7 acres

Total area = minimum of **36.1 acres**

The Service currently uses habitat in the form of appropriate sized elderberry shrub stems (>1 inch diameter) as a surrogate to quantify impacts to valley elderberry longhorn beetles. Valley elderberry longhorn beetles are small in size, and their life cycles and patchy habitats make detection difficult and the quantification of impacts to individual beetles impracticable.

According to the CWF BA, there is a total of 31,496.76 acres of modeled valley elderberry longhorn beetle habitat within the action area of the PA. Of that total, Reclamation and DWR have determined that 277.76 acres will be permanently affected and 106 acres will be temporarily affected for a total 383.76 acres of modeled habitat that will be adversely affected. The Service anticipates the mortality of all valley elderberry longhorn beetles within those 383.76 acres. As estimated in the CWF BA, within the 383.76 acres the PA would result in the loss of 83 elderberry shrubs, which will result in the loss of 1,558 elderberry stems of 1 inch diameter or greater.

9.8.4 Effects to Recovery

The loss of suitable habitat will have an adverse effect on the valley elderberry longhorn beetle. Additional actions including but not limited to dust accumulation, soil compaction, inappropriate herbicide, and fuel spills also have the potential to cause indirect adverse effects to the valley elderberry longhorn beetle. These threats will be minimized by Reclamation's and DWR's proposal to protect, create and enhance suitable habitat and implement avoidance and minimization measures for the valley elderberry longhorn beetle. The amount of habitat affected (approximately 383.76 acres of modeled habitat within 31,496.76 acres of modeled habitat) as a result of the construction of the water conveyance facilities will not appreciably alter conditions in the action area. The protection, creation and enhancement of riparian habitat may provide relatively greater benefit to the valley elderberry longhorn beetle because of the importance of this habitat type being conserved into perpetuity.

9.8.5 Reinitiation Triggers

Because elderberry shrubs will continue to grow, reproduce, and die, and continue to be impacted by environmental conditions, it is anticipated that at the time that construction activities begin, these totals (impact and mitigation) will likely be different. If that is the case, reinitiation of this consultation will be necessary to address effects to valley elderberry longhorn beetle that are not addressed in this BiOp.

9.8.6 Cumulative Effects

The activities described in Section 9.2.5 for delta smelt are also likely to affect valley elderberry longhorn beetle. These include agricultural practices, recreation, urbanization and industrialism, and greenhouse gas emissions. Therefore, the effects described in Section 9.2.5 are incorporated by reference into this analysis for the valley elderberry longhorn beetle.

9.8.7 Conclusion

In determining whether a proposed action is likely to jeopardize the continued existence of a species, we consider the effects of the action with respect to the reproduction, numbers, and distribution of the species. We also consider the effects of the action on the recovery of the species. In that context, the following paragraphs summarize the effects of the PA on the valley elderberry longhorn beetle.

Reproduction

The valley elderberry longhorn beetle is closely associated with elderberry, as these plants are an obligate host plant for larvae and are necessary for the completion of the life cycle. Approximately 277.76 acres of modeled valley elderberry longhorn beetle habitat that is assumed to be occupied by valley elderberry longhorn beetles are likely to be permanently lost due to construction of the conveyance facilities. Although this habitat is essential for valley elderberry longhorn beetle the area of effect is small compared to the amount of suitable habitat (31,496.76 acres modeled habitat) located within the action area. Therefore, the PA will not appreciably affect valley elderberry longhorn beetle reproduction, and we conclude that the effects would not reduce the range-wide reproductive capacity of the species.

Numbers

Comprehensive population surveys for the valley elderberry longhorn beetle, or its host plant, have not been conducted and thus the population size and location of the species in the action area is unknown, therefore estimating the number of valley elderberry longhorn beetles in the action area that may be affected by the construction of the conveyance facilities is difficult. There are only 3 reported occurrences of the valley elderberry longhorn beetle in the action area. The total area of potential effect (383.76 acres) associated with conveyance facility construction is small compared to the amount of suitable habitat (31,496.76 acres modeled habitat) located within the action area. Reclamation and DWR have proposed to preserve, create and enhance suitable habitat that will provide habitat for breeding, feeding and sheltering and would implement AMMs to further reduce potential impacts to the species. Despite the proposed protection measures, we anticipate the PA may still result in effects to the valley elderberry longhorn beetle; however, the number of valley elderberry longhorn beetles affected would be low. This is especially true relative to the range-wide numbers. Therefore, the PA will not appreciably reduce the number of valley elderberry longhorn beetles and we conclude the overall number of valley elderberry longhorn beetles throughout the species' range would not decline.

Distribution

The remaining presumed historical range of the valley elderberry longhorn beetle in the Central Valley consists of patchy distribution from Tehama County to Fresno County. The current distribution of valley elderberry longhorn beetles in the action area is largely unknown. The valley elderberry longhorn beetle population that could be affected by the conveyance facility construction is estimated to affect 383.76 acres of suitable modeled habitat within 31,496.76 acres of modeled habitat within the action area. We conclude that the valley elderberry longhorn beetles will continue to survive in the action area regardless of the activities. Consequently, the water conveyance facility construction will not alter the overall distribution of the valley elderberry longhorn beetle and we do not expect Reclamation's actions will reduce the species' distribution relative to its range-wide condition.

Effects on Recovery

For a species like the valley elderberry longhorn beetle that has lost much of its former known occupied habitat, recovery would necessitate the conservation of much of the remaining habitat that still supports it. Reclamation and DWR are proposing to minimize the adverse effects of the loss of modeled suitable habitat by implementing actions to promote the recovery of the affected species in a manner where the mitigation is commensurate with the adverse effect. Reclamation and DWR have proposed to preserve, create or enhance habitat to offset the total loss of suitable habitat. This habitat will be protected and managed for the conservation of the species in perpetuity and will provide habitat for breeding, feeding and sheltering and will help maintain the geographic distribution of the species and will contribute to the recovery of the species by increasing the amount of habitat that is secure from development threats and the other factors that threaten the species that can be addressed by habitat protection and management. Since habitat loss and degradation are contributing factors to the decline of the valley elderberry longhorn beetle; preservation, creation and enhancement of additional suitable habitat is a reasonable means of offsetting the adverse effects and may benefit the recovery of the valley elderberry longhorn beetle.

Conclusion

After reviewing the current status of the valley elderberry longhorn beetle, the environmental baseline for the action area, the effects of the PA, and the cumulative effects, it is the Service's biological opinion that the construction of the PA, as proposed, is not likely to jeopardize the continued existence of the species. We have reached this conclusion because:

1. The area of potential effect to the valley elderberry longhorn beetle is small and will not reduce the reproduction, numbers, and distribution of the species.

2. The low number of individuals likely to be affected by the project will not appreciably reduce the likelihood of valley elderberry longhorn beetles survival and recovery because many more individuals and larger habitat areas outside of the action area will remain.

3. Reclamation and DWR have proposed numerous and comprehensive measures to avoid and minimize potential effects.

4. Reclamation and DWR propose to protect, create, and enhance habitat that could support the valley elderberry longhorn beetle.